Easy Money in FTR Auctions

Devendra Canchi, Paul V. Preckel, Douglas J. Gotham, F.T. Sparrow

Devendra Canchi is a graduate research assistant for the State Utility Forecasting Group (SUFG); Paul Preckel is Professor of Agricultural Economics and Faculty Director of SUFG; Douglas Gotham is Director of SUFG; and F.T. Sparrow is Professor Emeritus of Industrial Engineering and former SUFG Director. SUFG is located in the Energy Center of Discovery Park at Purdue University, 500 Central Drive, West Lafayette, IN 47907-2022.

Poster prepared for presentation at the Agricultural & Applied Economics Association 2010 AAEA,CAES, & WAEA Joint Annual Meeting, Denver, Colorado, July 25-27, 2010

EASY MONEY IN FTR AUCTIONS

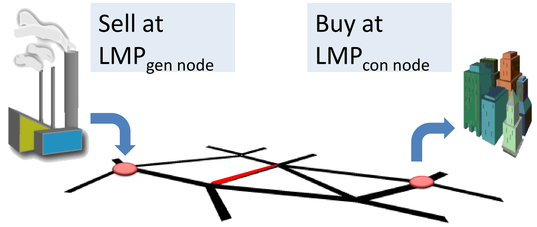
Devendra Canchi, Paul V. Preckel, Douglas J. Gotham, F.T. Sparrow
Purdue University

Electric Power

Electric Power is a peculiar commodity (lack of significant storage capability and need for substantial delivery infrastructure). Industry was highly regulated. In late eighties, a new system to regulate prices began to gain acceptance.

Nodal Pricing System

An institutional arrangement equipped to regulate prices in the wholesale electricity market to create an outcome mirroring that from a hypothetical competitive market equilibrium



Congestion Means Power flow on the line at its rated capacity

LMP: Locational Marginal Price, representing the opportunity cost of meeting a given demand situation, has three components.

$$\text{LMP} = \begin{bmatrix}\text{Marginal cost}\\ \text{of Generation}\end{bmatrix} + \begin{bmatrix}\text{Marginal cost}\\ \text{of Congestion}\end{bmatrix} + \begin{bmatrix}\text{Marginal cost}\\ \text{of Losses}\end{bmatrix}$$

All marginal costs are computed from the dual variables within the linear optimization problem solved by an independent entity to allocate generation assets for meeting demand reliably.

Opportunity cost associated with transmitting 1 MW of power flow from a given source node (point of injection) to a given sink node (point of withdrawal) is called congestion rent.

$$\begin{bmatrix}\text{Congestion}\\ \text{Rent}\end{bmatrix}_{A\to B} = \begin{bmatrix}\text{Marginal cost}\\ \text{of Congestion}\end{bmatrix}_{B} - \begin{bmatrix}\text{Marginal cost}\\ \text{of Congestion}\end{bmatrix}_{A}$$

Financial Transmission Rights

Congestion rents could be either positive or negative. They are highly volatile. Under the Nodal Pricing System, utility companies are exposed to an unprecedented uncertain price environment

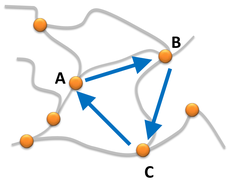
Hogan (1992)[1] suggested a hedging contract, came to be known as **Financial Transmission Right (FTR) Obligation**

FTR Obligation, designated in MWs and defined by source and sink nodes, affords the holder a counter cash flow to the congestion rent. For instance, a generator transmitting 1 MW of electric power from Node A to Node B, through holding a 1 MW A→B FTR earns a payoff that exactly offsets the incurred congestion rent. In contrast, negative congestion rent creates an obligation for the holder

[1]Hogan, William W. 1992. "Contract Networks for Electric Power Transmission." Journal of Regulatory Economics, 4(3), pp. 211-42.

FTR Obligation – A Unusual Financial Claim

The payoff structure immediately suggests that the payoff to a portfolio of FTRs (same period and same number of MWs), such that they form a closed loop, should be zero.



$$\text{Portfolio Payoff} = \left(\frac{[\text{MCC}]_B - [\text{MCC}]_A + [\text{MCC}]_C}{[\text{MCC}]_B + [\text{MCC}]_A - [\text{MCC}]_C}\right) = 0$$

Individual contracts yield uncertain payoffs, but the portfolio always yields a deterministic payoff of zero.

Auctions for FTR Obligations

In most wholesale electricity markets, FTR Obligations are sold in auction. In some markets, a multi round auction format is used. Investors' bids specify source sink and MW quantity. The winners and clearing prices are announce at the end of every round. The clearing prices inherit a structure. For any set of FTRs (of equal MWs) cleared in the same round that form a closed loop, the clearing prices sum to zero.

The pricing principle means, in any given round of the multi-round FTR auction, the portfolio of offsetting FTRs can only be acquired for $0

Auction Clearing price of portfolio $\{FTR_{A\to B}, FTR_{B\to C}, FTR_{C\to A}\} = 0$

In any given round of the FTR auction, clearing prices are hence consistent, i.e. a portfolio with deterministic zero payoff can only be acquired for $ 0.

There is no such guaranteed clearing in a multi-round format

The following was observed in 2007 Annual FTR auction conducted by PJM Interconnection, the largest wholesale market in the country

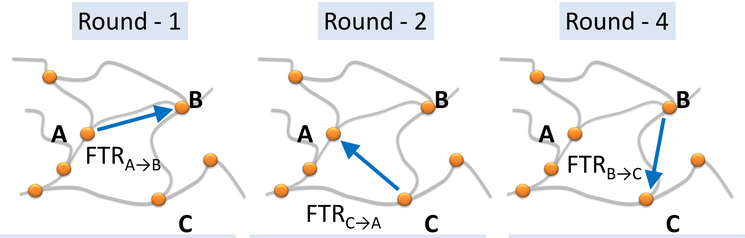
Clearing Prices ($/MW)

Round 1		Round 2		Round 4	
$FTR_{A\to B}$	$ - 25,838	$FTR_{A\to B}$	$ - 24,168	$FTR_{A\to B}$	$ - 23,686
$FTR_{B\to C}$	$ 9,621	$FTR_{B\to C}$	$ 8,512	$FTR_{B\to C}$	$ 5,493
$FTR_{C\to A}$	$ 16,216	$FTR_{C\to A}$	$ 15,656	$FTR_{C\to A}$	$ 18,193

In every round, clearing prices sum to zero.

Opportunity for Profitable Bidding

Consider a investor, who acquired the following three FTR Obligations in this auction.



$FTR_{A\to B}$ for **$ - 25,838** | $FTR_{C\to A}$ for **$ 15,656** | $FTR_{B\to C}$ for **$ 5,493**

Earned Risk-Free profit **$ 4,689 per MW**

The portfolio earns a deterministic zero-payoff. The investor acquired this zero-payoff portfolio of $ - 4,689 per MW

Risk Free Profits – Do they occur?

Bidders identities are not made public. Hence it is hard to conclusively determine if investors are successful in acquiring offsetting portfolios. Each round winners are however declared

In some cases, it is possible to impute bidders identities. Nearly 250 instances of profitable bidding have been identified by imputing bidders identities.

More importantly, given the pricing principle if prices decline progressively from one round to another, we cannot reject the possibility of bidders profitably acquiring offsetting portfolios.

Deviations in the 2007 Annual FTR Auction conducted by PJM Interconnection.

		Round 1	Round 2	Round 3
Average Deviation ($/MW)	Round 2	676.71		
Skewness of Deviation ($/MW)		1.31		
Percent MW (non positive dev.)		51%		
Percent FTRs (non positive dev.)		55%		
Average Deviation ($/MW)	Round 3	-1,580.97	-2,995.61	
Skewness of Deviation ($/MW)		-6.76	-8.04	
Percent MW (non positive dev.)		47%	53%	
Percent FTRs (non positive dev.)		48%	62%	
Average Deviation ($/MW)	Round 4	-3,059.09	-3,765.68	-1,759.77
Skewness of Deviation ($/MW)		-7.47	-7.00	-6.76
Percent MW (non positive dev.)		48%	56%	58%

Except for Round 2 versus Round 1, prices progressively decline in this auction. Hence we cannot reject the possibility that investors profitably acquire offsetting portfolios.

Conclusions

A shortcoming of multi-round auction for FTR Obligations is described.

Examination of PJM auction data reveals that some investors are benefiting from transactions that result in risk-free profit.

A thorough analysis involving the strategic behavior of the auction participants will greatly improve our understanding of these markets and potentially improve their overall efficiency.